

The Teaching of Botany.

I do not think there is at present any book in English giving practical instructions for experiments in Physiological Botany. There is, however, an excellent book of this kind in German, Dr. W. Detmer's "Das pflanzen-physiologische Praktikum," published by Gustav Fischer, Jena, 1888. This, no doubt, contains all that your correspondent "A. H." (*NATURE*, ante, p. 151) requires, though it is perhaps somewhat more advanced than is necessary for school teaching. D. H. SCOTT.

Old Palace, Richmond, Surrey.

THE ORIGIN OF THE YEAR.¹

IV.

THE reformation of the Egyptian calendar, to be gathered, as I suggested in my last article, from the decree of Tanis, is not, however, the point to which reference is generally made in connection with the decree. The attempt recorded by it to get rid of the vague year is generally dwelt on.

Although the system of reckoning which was based on the vague year had advantages with which it has not been sufficiently credited, undoubtedly it had its drawbacks.

The tetramenes, with their special symbolism of flood, seed, and harvest time, had apparently all meant each in turn; however, the meanings of the signs were changed, the "winter season" occurred in this way in the height of summer, the "sowing time" when the whole land was inundated, and there was no land to plant, and so on. Each festival, too, swept through the year. Still, it is quite certain that information was given by the priests each year in advance, so that agriculture did not suffer; for if this had not been done, the system, instead of dying hard, as it did, would have been abolished thousands of years before.

Before I proceed to state shortly what happened with regard to the fixing of the year, it will be convenient here to state a suggestion that has occurred to me, on astronomical grounds, with regard to the initial change of gn.

It is to be noted that in the old tables of the months, instead of Sirius leading the year, we have Texi with the two eaters of Amen. In later times this is changed to Sirius.

I believe it is generally acknowledged that the month tables at the Ramesseum is the oldest one we have; there is a variant at Edfu. They both run as follows, and no doubt they had their origin when a 1st Thoth coincided with an heliacal rising and Nile flood.

Egyptian month.	Tropical month.	Ramesseum.	Edfu.
Thoth	June-July	Texi	Tex
Phaophi	July-Aug.	Ptah (Ptah-res-aneb-f)	Ptah (Menχ)
Athyr	Aug.-Sep.	Hathor	?
Choiak	Sep.-Oct.	Paχt	Kehek
Tybi	Oct.-Nov.	Min	Set-but
Mechir	Nov.-Dec.	Jackal (rekḥ-ur)	Hippopotamus (rekḥur)
Phamenoth	Dec.-Jan.	„ (rekḥ-netches)	Hippopotamus (rekḥ-netches)
Pharmuthi	Jan.-Feb.	Rennuti	Renen
Pachon	Feb.-Mar.	χensu	χensu
Payni	Mar.-Ap.	Horus (χonti)	Horus (Hor-χent-χati)
Epiphi	Ap.-May	Āpet	Āpet
Mesori	May-June	Horus (Hor-m-χut)	Horus (Hor-ra-m-χut)

I am informed that Texi, in the above month-list, has some relation to Thoth. In the early month-list the goddess is represented with the two feathers of Amen, and in this early stage I fancy we can recognize her as

¹ Continued from p. 35.

Amen-t; but in later copies of the table the symbol is changed to that of *Sirius*. This, then, looks like a change of cult depending upon the introduction of a new star—that is, a star indicating by its heliacal rising the Nile rise after the one first used had become useless for such a purpose.

I have said that the Ramesseum month list is probably the oldest one we have. It is considered by some to date only from Ramses II., and to indicate a fixed year; such, however, is not Krall's opinion.¹ He writes:—

"The latest investigations of Dümichen show that the calendar of Medinet-Abu is only a copy of the original composed under Ramses II. about 120 years before. . . .

"But the true original of the calendar of Medinet-Abu does not even date from the time of Ramses II. It is known to every Egyptologist how little the time of the Ramessids produced what was truly original, how much just this time restricted itself to a reproduction of the traditions of previous generations. In the calendar of Medinet-Abu we have (p. 48) not a fixed year instituted under Ramses II., but the normal year of the old time, the vague year, as it was, to use Dschewhari's words quoted above (p. 852), in the first year of its institution, the year as it was before the Egyptians had made two unwelcome observations: First, that the year of 365 days did not correspond to the reality, but shifted by one day in four years with regard to the seasons; secondly—which of course took a much longer time—that the rising of Sirius ceased to coincide with the beginning of the Nile flood.

"We are led to the same conclusion by a consideration of the festivals given in the calendar of Medinet-Abu. They are almost without exception the festivals which we have found in our previous investigation of the calendars of Esne and Edfu to be attached to the same days. We know already the Uaya festival of the 17th and 18th Thoth, the festival of Hermes of the 19th Thoth, the great feast of Amen beginning on the 19th Paophi, the Osiris festivals of the last decade of Choiak, and that of the coronation of Horus on the 1st Tybi.

"Festivals somehow differing from the ancient traditions, and general usage are unknown in the calendar of Medinet-Abu, and it is just such festivals which have enabled us to trace fixed years in the calendars of Edfu and Esne.

"We are as little justified in considering the mythologico-astronomical representations and inscriptions on the graves of the time of the Ramessids as founded on a fixed year, as we can do this in the case of the Medinet-Abu calendar. In this the astronomical element of the calendar is quite overgrown by the mythological. Not only was the daily and yearly course of the sun a most important event for the Egyptian astronomer, but the priest also had in his sacred books many mythological records concerning the god Rā, which had to be taken into account in these representations. The mythological ideas dated from the oldest periods of Egyptian history; we shall, therefore, be obliged for their explanation not to remain in the 13th or 14th century before Christ, but to ascend into previous centuries; *I should think about the middle of the fourth millennium before Christ, that is the time at which the true original of the Medinet-Abu calendar was framed.* Further we must in these mythological and astronomical representations not overlook the fact that we cannot expect them to show mathematical accuracy—that, on the contrary, if that is a consideration, we must proceed with the greatest caution. We know now how inexact were the representations and texts of tombs, especially where the Egyptian artist could suppose that no human eye would inspect his work; we also know how often representations stop short for want of room, and how much the contents were mutilated for the sake of symmetry."

¹ *Op. cit.* p. 43.

There is also, as I have indicated, temple evidence that Sirius was not the first star utilized as a herald of sunrise. We have then this possibility to explain the variation from the true meaning of the signs in Ramessid times.

Pre-Sirian. Texi	Thoth	Phaophi	Athyr	Chouk	Tybi	Wechir	Phamenoth	Pachons	Epiphi
Sirian, 3192 B.C.	Thoth	Phaophi	Athyr	Chouk	Tybi	Wechir	Phamenoth	Pachons	Epiphi

And it may be gathered from this that the Calendar was reorganized¹ when the Sirius worship came in and that the change effected in 619 B.C. brought the hieroglyphic signs back to their natural meaning and first use.

Before I pass on it may be convenient in connection with the above month-tables to refer in the briefest way to the mythology relating to the yearly movement of the sun, in order to show that when this question is considered at all, if it helps us with regard to the mythology connected with the rising and setting of stars, it will as assuredly help us with regard to the mythology of the various changes which occur throughout the year.

We have, as we have seen, in the Egyptian year really the prototype of our own. The Egyptians, thousands of years ago, had an almost perfect year containing twelve months, but instead of four seasons they had three, the time of the sowing, the time of the harvest, and the time of the inundation. Unfortunately, at various times in Egyptian history, the symbols for the tetramenes seem to have got changed.

The above-given inscriptions show that they had a distinct symbolism for each of the months. Gods or goddesses are given for ten months out of the twelve, and where we have not these, we have the hippopotamus (or the pig) and the jackal, two circumpolar constellations. I think there is no question that we are dealing here with these constellations, though the figures have been supposed to represent something quite different.

There are also myths and symbols of the twelve changes during the twelve hours of the day; the sun being figured as a child at rising, as an old man when setting in the evening. These ideas were also transferred to the annual motion of the sun. In Macrobius, as quoted by Krall, we find the statement that the Egyptians compared the yearly course of the sun also with the phases of human life.

Little child	=	Winter solstice.
Young man	=	Spring equinox.
Bearded man	=	Summer solstice.
Old man	=	Autumnal equinox.

With the day of the summer solstice the sun reaches the greatest northern rising amplitude, and at the winter solstice its greatest southern amplitude. By the solstices the year is divided into two approximately equal parts; during the one the points of rising move southwards, during the other northwards.

This phenomenon, it is stated, was symbolized by the two eyes of Rā, the so-called Utchats, which look in different directions. They appear as representing the sun in the two halves of the year.

We have next to discuss the fixed year, to which the Egyptian chronologists were finally driven in later Egyptian times.

The decree of Tanis was the true precursor of the

¹ Goodwin has already asked, "Does the Smith Papyrus refer to some rectification of the Calendar made in the 4th Dynasty, similar to that made in Europe from the old to the new style," quoted by Riel, "Sonnen- und Sirius-Jahr," p. 361.

Julian correction of the calendar. In consequence of this correction *we* now add a day every four years to the end of February. The decree regulated the addition, by the Egyptians, of a day every four years by adding a day to the epacts, which were thus 6 every four years instead of being always 5 as they had been before.

In fact it replaced the vague year by the sacred year long known to the priests.

But if everything had gone on then as the priests of Tanis imagined, the Egyptian new year's day, *if* determined by the heliacal rising of Sirius, would not always afterwards have been the 1st of Payni, although the solstice and Nile flood would have been due at Memphis about the 1st of Pachons; and this is, perhaps, one among the reasons why the decree was to a large extent ignored.

Hence, for some years after the date of the decree of Tanis there were at least three years in force: the new fixed year, the new vague year, reckoning from Pachons, and the old vague year, reckoning from Thoth.

But after some years another attempt was made to get rid of all this confusion. The time was 23 B.C., 216 years after the decree of Tanis, and the place was Alexandria. Hence the new fixed year introduced is termed the Alexandrine year.

This new attempt obviously implied that the first one had failed; and the fact that the vague year was continued in the interval is sufficiently demonstrated by the fact that the new year was $2\frac{1}{4}$ = 54 days *en retard*. In the year of Tanis it is stated that the 1st Pachons, the new New Year's Day, the real beginning of the flood, fell on the 19th of June (Gregorian), the summer solstice, and hence the 1st of Thoth fell on the 22nd of October (Gregorian). In the Alexandrine year the 22nd of October is represented by the 29th of August, and the 19th of June by the 20th of April.

It is noteworthy that in the Alexandrine year the heliacal rising of Sirius on the 23rd of July (Julian) falls on the 29th of Epiphi, nearly the same date as that to which I first drew attention in the inscriptions of the date of Thotmes and Pepi. This, however, it is now clearly seen, is a pure accident, due to the break of continuity before the Tanis year, and the *slip* between that and the Alexandrine one. It is important to mention this, because it has been thought that somehow the "Alexandrine year" was in use in Pepi's time!

It would seem that the Alexandrine revision was final, and that the year was truly fixed, and from that time to this it has remained so, and must in the future for ever remain so. It must never be forgotten that we owe this perfection to the Egyptians.

One of the chief uses of the Egyptian calendar that has come down to us was the arrangement and dating of the chief feasts throughout the year in the different temples.

The fact that the two great complete feast calendars of Edfu and Esne refer to the only fixed years evidenced by records, those of Tanis and Alexandria, one of which was established over 200 years after the other, is of inestimable value for the investigation of the calendar and chronology of ancient Egypt.

In an excellent work of Brugsch, "Three Festival Calendars from the Temple of Apollinopolis Magna (Edfu) in Upper Egypt," we have two calendars which we can refer to fixed years, and can date with the greatest accuracy. In the case of one of these, that of Esne, this is universally recognized; as to the other, that of Apollinopolis Magna, we are indebted to the researches of Krall, who points out, however, that "it is only when the province of Egyptian mythology has been dealt with in all directions, that we can undertake a successful explanation of the festival catalogues. Even externally they show the greatest eccentricities, which are not diminished but increased on a closer investigation."

About some points, however, there is no question. The summer solstice is attached in the Edfu calendar to the 6th Pachons, according to Krall, while the beginning of the flood is noted on the 1st of that month. In the Esne calendar, the 26th Payni is New Year's Day. We read:—"26th Payni, New Year's Day, Feast of the Revelation of Kahi in the Temple. To dress the crocodiles, as in the month of Mechir, day 8."

Peculiar to the Esne calendar, according to Krall, is the mentioning of the "New Year's Festival of the Ancestors" on the 9th of Thoth; to the Edfu calendar, publication No. 1 of Brugsch, the festival "of the offering of the first of the harvested fruits, after the precept of King Amenemha I.," on the 1st Epiphi, and "the celebration of the feast of the great conflagration" on the 9th of Mechir. In feast calendar No. 1, the reference to the peculiar Feast of Set, is also remarkable, this was celebrated twice, first in the first days of Thoth (? 9th?), then, as it appears, in Pachons (10th). This feast is well known to have been first mentioned under the old Pharaoh Pepi Merinra.

It is a question whether in the new year of the ancestors and the feasts of Set, all occurring about the 9th Thoth and Pachons, we have not Memphis Festivals which gave way to Theban ones, for so far as I can make out the flood takes about nine days to pass from Thebes to Memphis, so that in Theban time the arrival of the flood at Memphis would occur on 9th or 10th Thoth. There is no difficulty about the second dating in Pachons, for as we have seen this followed on the reconstruction of the calendar.

It is also worthy of note that the feast of the "Great Conflagration" took place very near the Spring Equinox.

It is well to dwell for a moment on the Edfu inscriptions to see if we can learn from them whether they bear out or not the views brought forward with regard to this reconstruction.

As we have seen it is now acknowledged that the temple inscriptions at Edfu (which are stated to have been cut between 117 and 81 B.C.) are based upon the fixed year of Tanis; hence we should expect that the rising of Sirius would be referred to on 1 Payni, and this is so. But here, as in the other temples, we get double dates referring to the old calendars, and we find the "wounding of Set" referred to on the 1st Epiphi and the rising of Sirius referred to under 1 Messori. Now this means, if the old vague year is referred to, as it most probably is, that

5 Epacts
30 Messori

—
 $35 \times 4 = 140$ years

had elapsed since the beginning of a Sothic cycle, when the calendar coincidences were determined, which were afterwards inscribed on the temple walls. We have, then, 140 years to subtract from the beginning of the cycle in 270 B.C. This gives us 130 B.C., and it will be seen that this agrees as closely as can be expected with my view, whereas the inscription has no meaning at all if we take the date given by Censorinus.

I quote from Krall² another inscription common to Edfu and Esne, which seems to have astronomical significance.

"1. Phamenot. Festival of the suspension of the sky by Ptah, by the side of the god Harschaf, the master of Heracleopolis Magna (A1). Festival of Ptah. Feast of the suspension of the sky (Es).

"Under the 1st Phamenot, Plutarch, de Iside ac Osiride c. 43, b, notices the *ἐμβασις Ὀσίριδος εἰς τὴν σελήνην*. These are festivals connected with the celebration of the winter solstice, and the filling of the Uza-

eye on the 30th Mechir. Perhaps the old year, which the Egyptians introduced into the Nile valley at the time of their immigration, and which had only 360 days, commenced with the winter solstice. Thus we should have in the 'festival of the suspension of the sky,' by the ancient god Ptah—venerated as creator of the world—a remnant of the time when the winter solstice marked the beginning of the year, and also the creation."

The reconstruction of the calendar naturally enhanced the importance of the month Pachons; this comes out very clearly from the inscriptions translated by Brugsch. On this point Krall remarks:—

"It is therefore quite right that the month Pachons, which took the place of the old Thoth by the decree of Tanis, should play a prominent part in the feast calendars of the days of the Ptolemies, and the first period of the Empire in general, but especially in the Edfu calendar, which refers to the Tanitic year. The first five days of Pachons are dedicated in our calendar to the celebration of the subjection of the enemies by Horus; we at once remember the above mentioned (p. 7) record of Edfu of the nature of a mythological calendar, describing the advent of the Nile flood. On the 6th of Pachons—remember the great importance of the sixes in the Ptolemaean records—the solstice is then celebrated. The Uza-eye is then filled, a mythical act which we have in another place referred to the celebration of the solstice, and "everything is performed which is ordained" in the book "on the Divine Birth."

Next let us turn to Esne. The inscriptions here are stated to be based on the Alexandrian year, but we not only find 1st Thoth given as New Year's Day, but 26 Payni given as the beginning of the Nile flood.

Now I have already stated that the Alexandrine year was practically a fixing of the vague Tanis year; that is, a year beginning on 1st Pachons in 239 B.C.

If we assume the date of the calendar coincidences recorded at Esne to have been 15 B.C. (we know it was after 23 B.C. and at the end of the Roman dominion), we have as before, seeing that, if the vague Tanis year had really continued, it would have swept forward with regard to the Nile flood,

Pachons 30
Payni 26

—
 $56 \times 4 = 224$ years after 239 B.C.

This double dating, then, proves the continuation of the vague year of Tanis if the date 15 B.C. of the inscription is about right.

Can we go further and find a trace of the old cycle beginning 270 B.C.? In this case we should have the rising of Sirius

270
— 15
—
4)255 years

—
64 = say 5 Epacts and 2 months.

This would give us 1 Epiphi. Is this mentioned in the Esne calendar? Yes, it is, "1 Epiphi. To perform the precepts of the book on the second divine birth of the child Kahi."

Now the 26th Payni, the new New's Year Day, is associated with the "revelation of Kahi," so it is not impossible that "the second divine birth" may have some dim reference to the feast.

It is not necessary to pursue this intricate subject further in this place; so intricate is it that, although the suggestions I have ventured to make on astronomical grounds seem consistent with the available facts, they are suggestions only, and a long labour on the part of Egyptologists will be needed before we can be said to be on firm ground.

J. NORMAN LOCKYER.

¹ On the 7th Epiphi of the 10th year of Ptolemy III. the ceremony of the stretching of the cord took place, Dümichen, Aeg. Z. 2, 1872, p. 41.

² *Op. cit.*, p. 37.